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ABSTRACT

In order to prepare children for the responsibilities of citizenship in a technological society, the Science, Technology and Society (STS) approach, which integrates various subject matter disciplines, can be implemented through the use of children's literature. In this way, STS units combine language arts, reading and literature, and teach and emphasize reading and writing in the meaningful context of science, as well as social studies, math, and the arts. By using books which have a strong story line and are of interest to children, facts and ideas can be presented as part of the world which they know or perceive. For example, Virginia L. Burton's "Mike Mulligan and His Steam Shovel" illustrates several of the problems of a rapidly changing society, including the themes of change and obsolescence. The societal issues which confront children at an early age can be addressed, enabling children to develop effective thinking skills and communicate their ability to think and make decisions. (Attached materials include a sample STS unit; activity suggestions by topic; classroom, small group, and individual activity suggestions; a list of additional resources, a bibliography of STS related children's literature for primary grades, and eight references.) (MM)

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Science, Technology and Society as Experienced through Children's Literature

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"The most logical place for instruction in most reading and thinking strategies is in social studies and science rather than in separate lessons about reading. The reason is that strategies are useful mainly when the student is grappling with important but unfamiliar content. The idea that reading instruction and subject matter instruction should be integrated is an old one in education, but there is little indication that such integration occurs often in practice" (Anderson, 1985). This statement, issued by the Commission on Reading, is indicative of the direction that many educators feel must be taken to insure continued growth and reform in American education today.

In discussing curriculum growth in general, John Goodlad (1986) calls for the necessity of transcending subject divisions as a means of involving students as participators in the thinking process, rather than as passive observers. William Glasser (1986) states that learning will become more meaningful to students as topics are treated in depth and center around the needs of the youngsters. Teachers will be able to act as facilitators in the learning process if they can approach their discipline with a wider scope, instead of dispensing the dictates of a narrow curriculum.

1 Research in the area of science education concludes that the elementary school must capitalize on the integration of science with other subjects to help students learn how to become critical thinkers and decision makers (Gates, Krockover, and Wiedermann, 1988). Not only must the barriers between subject

areas be erased, but it must be realized that the teaching of suject matter and instruction in process skills cannot exist as separate entities, because problem-solving activities are not content-independent (Hodson, 1988). Even when science becomes more specialized in the upper grades, an integrated approach emphasizing methodology would be preferable as a means of introducing interdisciplinary science.

The Science, Technology and Society movement is a means of integrating various subject matter disciplines as well as process skills. The purpose of STS is to empower learners to make judgments about the use of science and technology in their daily lives. It assists students in developing problem solving skills based on the analysis of situations which affect choices and human values.

It is necessary to begin preparing children for the responsibilities of citizenship in a technological society as soon as possible, i.e. the elementary school. Endless varieties of societal issues begin confronting children at a very early age. We cannot be content merely with making them aware of these issues, but should enable them to develop effective thinking skills and be able to communicate their ability to think and make decisions.

To be able to read and write is not sufficient to constitute literacy in today's technological world. The skills and strategies gained from the reading-writing process must be integrated with other subject areas of the curriculum to enable

students to also be literate in other areas such as science and technology. Jacobson defines "scientific literacy" as "the ability to understand and discuss developments in science and technology as they are communicated via newspaper, magazines, television and other public media. To be scientifically literate is to be able to participate in the explorations and new developments taking place in science and technology and to understand and be able to discuss some of the results of these investigations and their possible implications." Technological literacy is the "possession of a reasonable understanding of the behavior of technological systems and requires knowledge of scientific and mathematical concepts. Along with this must go an understanding of certain underlying concepts that are unique to engineering. People must understand the limitations as well as the capabilities of emerging technology. The technologically literate person should have a sense of what technology can and cannot do. He or she should not believe that technology can solve all ills, nor that technology is responsible for most problems" (National Science Board Commission on Pre-College Education in Mathematics, Science and Technology).

Besides the philosophical aspect of starting STS instruction in the elementary school, there are many practical reasons for doing this. Young children are naturally curious and often choose science as their favorite subject (Stake and Easley, 1979). The self-contained classroom, which predominates in most schools, lends itself to the integration of various disciplines,

as children are not changing rooms for each subject. One teacher is generally in charge of the majority of the instructional day for that class and could plan units based on STS.

Looking at the negative side of the issue, research indicates that elementary teachers still view science as one of the weakest links in their professional preparation, and consequently do not give it priority as an area of instruction. The majority of teachers mention lack of time as the major reason for not teaching science, with the result that time allotted to science instruction continues to decrease (Gates, Krockover, and Wiedermann, 1988).

One of the easiest methods of including STS instruction in the elementary curriculum is through the use of children's literature. Language arts, reading and literature are not only areas of great strength for many teachers at the primary level, but up to half of the ordinary school day is usually allotted to reading and languages arts. By integrating STS units into the language portion of the day, time is not taken from the reading period. The result is actually the reverse. Reading and writing will be continually taught and emphasized, but in the meaningful context of science, as well as social studies, math and the arts. Various disciplines can be viewed in relation to the total society in which the child lives and not in the isolation of the classroom.

This method of using fictional children's literature as a basis for STS instruction can begin as early as kindergarten.

Picture books would be the most common source until about grade 3, although many of these works could be enjoyed by middle school youngsters. Only the complexity of the activities would increase. For example, Mike Mulligan and his Steam Shovel by Virginia Lee Burton illustrates several of the problems of a rapidly changing society. In this book, the steam shovel becomes outdated by more modern equipment. A child suggests an alternative use for the steam shovel as a heating plant for the town hall. Themes of change and obsolescence are expressed in the text. Activities might range from observing simple hand tools like a can opener, for younger children, to building a working steam shovel from plastic blocks for older children. Whereas young children might visit a hardware store and describe, in words, the machines they have seen, older children could write sequential directions for operating various devices. Finding the sources of heat for the school building, experimenting with simple machines or even interviewing a steam shovel operator can give much more insight into the concepts found in the book. To expand on the societal issue of old age, additional works on how people grow old can be added to the unit - e.g. Nana Upstairs, Nana Downstairs by Tomie dePaola and I Know An Old Lady by Charlotte Zolotow.

By using books which have a strong story line and are of interest to children, facts and ideas are presented as part of the world which they know or can perceive. Knowledge acquisition is not equated with ingesting isolated bits of information which

are never conceptualized, and are therefore quickly lost. By dealing with an issue such as obsolescence as it relates to society, children realize that objects (and people) move, work and grow older. Change is one of the most constant factors in their lives and its influence will continue to accelerate as the amount of knowledge available to mankind continues to double every few years.

Our schools have neither the time nor the facility to continue instructing children in isolated units which are compartmentalized into specific time blocks. By using children's literature as a basis for learning about an issue which affects all society, many areas of knowledge have been integrated. In doing so, educators will achieve the objectives of helping children develop the problem solving and communication skills that they will need for the future.

Example STS Unit

A Synopsis of In Coal Country as an Instructional Unit

In Coal Country - written by Judith Hendershot; illustrated by Thomas B. Allen. This is a simple portrait of life in a small Ohio coal mining town in the 1930's as seen through the eyes of a little girl who grew up there.

ACTIVITY SUGGESTIONS, BY TOPIC

Father

Carol and John Butzow, page 6

Job - describe his job
- what jobs are represented by some of the father's in the classroom
- are certain jobs restricted to men

Clothing - special uniform and equipment used
- special clothing worn by parents of students
- occupations which require specific clothing
- displays of special uniforms or equipment (this could come from catalogs, magazines, photos, or students could dress up to represent an occupation - maybe for Halloween)

Shift work - what is it? what names did miners use?
- what present day jobs involve shift work?
- what is the length of the average working day?
- make a frequency chart of occupations of student's parents

Transportation to work - then vs. now
- urban vs. rural
- writing class about getting to school/e.g. incident on bus, loosing lunch on the way, etc.

Vacations - isolation of people in book; didn't travel
- map places children have visited/have relatives

<u>Mother</u>

Duties - description in book
- jobs of students' mothers
- try to do laundry with old washboard, copper boiler, bar soap, carry water
- food preservation/comparison of then and now
- try to preserve pickles or tomatoes in class (Compare to R. McCloskey's <u>Blueberries for Sal</u>)
- importance of the garden/crops; do students have garden at home/crops
- baking/different equipment from today/ find pictures of old stoves, iceboxes, etc.

House - what would it be like? electrical appliances?

<u>Children</u>

Chores - jobs before and after school

School - kind of school; infer importance; classes; compare to theirs/dramatize a one room school house situation by dividing children into

grades with different work, etc.

Games - recreation they had; dependence on seasons; research games mentioned and play them; ask grandparents which games they played; make up jump rope rhymes about living in coal town

Town

Isolation - geographic and economic
- make large map or model of village and area indicating all locations mentioned;
- all men have same occupation
- company town
- company store/items carried
- have children keep track for one week of all stores, restaurants, places of entertainment, forms of transportation used, places visited, etc. and compare to isolation of this town

Environment

Physical - describe landforms (needed for map)

Pollution - water in creek
- coal smell and dust
- paint peeling from houses
- simulate pollution effects:
  Sprout radish seeds, water half with pure water/half with water-coal dust mixture (dilute citrus juice or vinegar will produce similar results); observe over several days and compare growth

OTHER ACTIVITIES - CLASSROOM, SMALL GROUP, INDIVIDUAL

Mapping - coal producing areas of your state, U.S.A., other countries; find names of towns which show a connection to coal e.g. Lucernemines, Outcrop

Charts - coal production/amount and economic value; select specific state, region, county

Filmstrips and videos - see bibliography

Dramatize or pantomime the book or sections of it; write a play using these people as main characters, to show what their life is like - e.g. Christmas activities; stage one of the energy plays (see bibliography for book)

Compare popular songs about coal miners to the people in this book (see bibliography)

Interview people: one who attended a one room school house
someone who grew up in a coal mining town
a present day coal miner
a retired coal miner
(Questions should be carefully written to elicit explanatory answers, not just "yes" or "no")

Look at pictures of old coal mining equipment and discuss the purpose of each. How have they changed? (See addresses in bibliography for sources or use encyclopedia, non-fiction book on coal, etc.)

Make sketches or copies of the coal mining process and sequence them.

Look at pieces of coal and describe them carefully; compare to other rocks or minerals you can find

Read other books on children from coal mining towns.

Write a week long journal as if you were one of the members of this community (you can choose people who are not directly mentioned, e.g. the school teacher, store clerk)

Find news clippings about the coal industry. This can include information on acid rain caused by coal dust in the air.

Make a booklet of mini-reports on topics such as the formation of coal, kinds of coal, uses of coal and byproducts, strip vs. shaft mining, early mining in England, equipment, mine safety, etc. In all cases students might compare past and present methods. Most children's encyclopediae are sufficiently detailed to use as a resource.

Additional Resources

Rochester and Pittsburgh Coal Company
655 Church Street
Indiana, Pa. 15701
412/349-5880

Anthracite Museum Complex
R.D. No. 1
Bald Mt. Road
Scranton, Pa. 18504
717/961-4804

Ms. Maya Phelps
American Coal Foundation
918 16th Street, N.W.
Suite 404

Washington, D.C.
202/466-8630

Coal, The Bridge to the Future
A Video Presentation
EXXON Corporation

Coal Miners of Appalachia
Rural America Series
National Geographic Society
Filmstrip No. 03229

A Field Trip to a Coal Mine
Field Trips Out of the Ordinary Series
Eye Gate House
Jamaica, New York 11435
Filmstrip No. X338-B

Energy Plays for Children and Other Lively People
Robert Kane
Energy Information and Education Division
Philadelphia Electric Company
P.O. Box 71
Coatesville, Pa. 19320

Coal Miner's Daughter
Loretta Lynn's Greatest Hits Vol. 2
NCA Records 2353

Sixteen Tons
Recorded by "Tennessee" Ernie Ford
The Greatest hits of the '50's and '60's
Plaza House SLB-6718

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Carol Butzow holds degrees in history from St. Bonaventure University and Colgate University, as well as an MEd in reading from the University of Maine. She has taught social studies, English and reading in the public schools and reading at the junior college level. At present she is a reading consultant and a doctoral candidate at Indiana University of Pennsylvania. Her area of major interest is the acquisition of initial reading and writing skills by elementary students, and the integration of these skills into the content areas, especially science.

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John Butzow has a B.S. and an M.S. in chemistry from St. Bonaventure University, and an EdD from the University of Rochester. For many years he taught science and methods courses at the University of Maine, and also developed special projects in marine, environmental and computer education. He is now associate dean of education at Indiana University of Pennsylvania and conducts workshops on the integration of science and language arts through the use of children's literature. He and his wife have several articles on this topic in press, and John has published widely in the field of science education.